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(71) Applicant
Shimuzu Construction Co., Ltd

(Incorporated in Japan)

2-16-1 Kyobashi, Chuo-ku, Tokyo 104, Japan

(72) Inventors
Masao Obata
Tatsuya Furuta
Tadahiko Suzuki
Hitoshi Ide
Kazutaka Okawara
Yasukazu Nakamura
Teruo Orikasa
Hirotake Takisawa
Nobuo Tanaka

(74) Agent and/or Address for Service
Gee and Co
Chancery House, Chancery Lane, London, WC2A 1QU, United Kingdom

(54) Sound insulating walls

(57) A wall comprises a sound absorbing material (113), e.g. glass wool sandwiched between a pair of light-weight panels (115), each comprising a wire mesh truss (122) constructed of two layers of wire mesh formed of wires (119, 120) and joined by truss ribs (121); a layer of light-weight mortar which may be expandable (123) is formed on each truss, and a layer of ordinary mortar 125, which may be of different hardness to the light-weight mortar, is formed thereon on the job site using a mold. The wall can be secured to the floors above and below in the building by use of fixing channels (127, 129). Adjacent co-planar panels are joined together by placing a wire mesh in a recess 126 of the layer 125, the mesh spanning the joint between panels, and filling the recess 126 with mortar.

Fig. 2

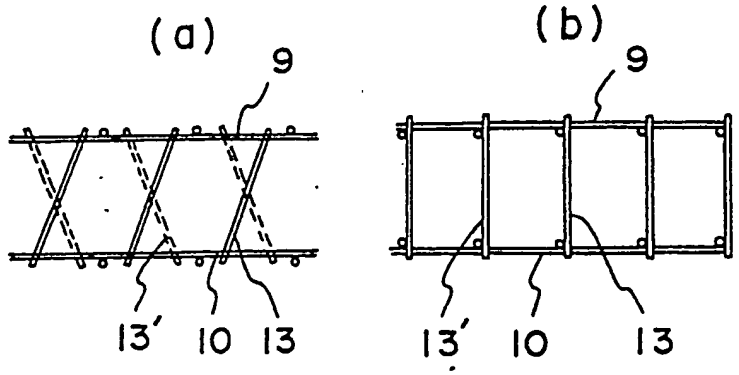

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Fig. 2

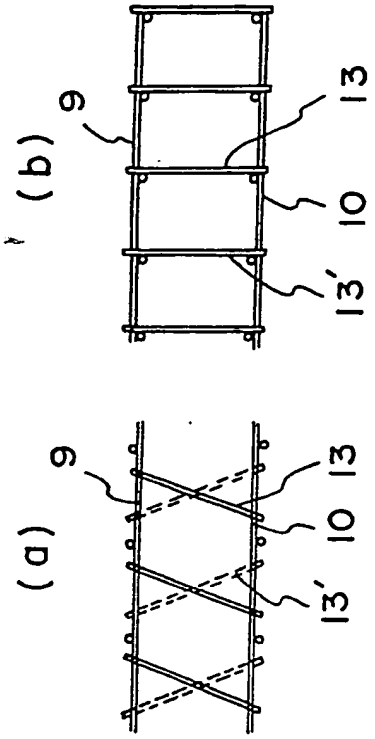


Fig. 1

Fig. 3

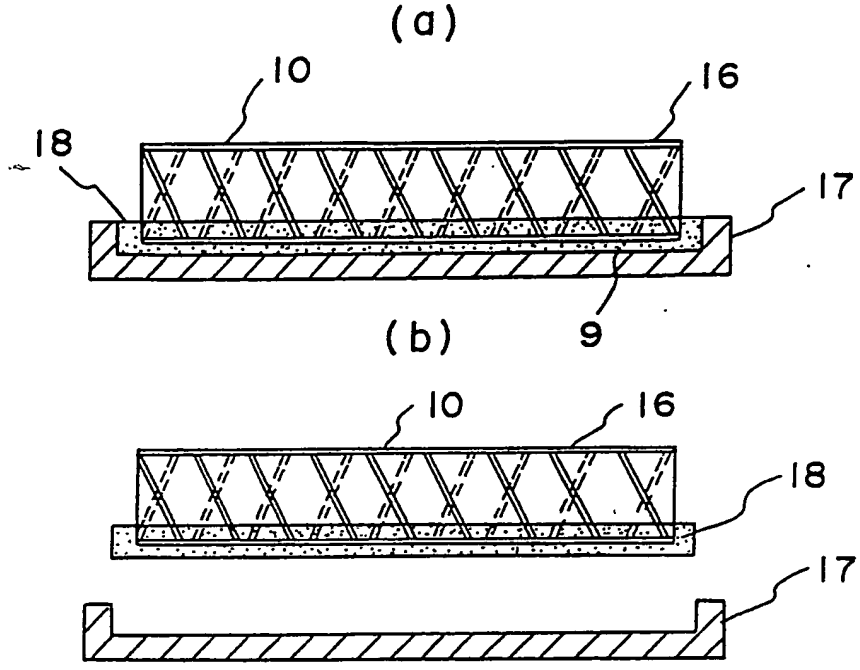


Fig. 4

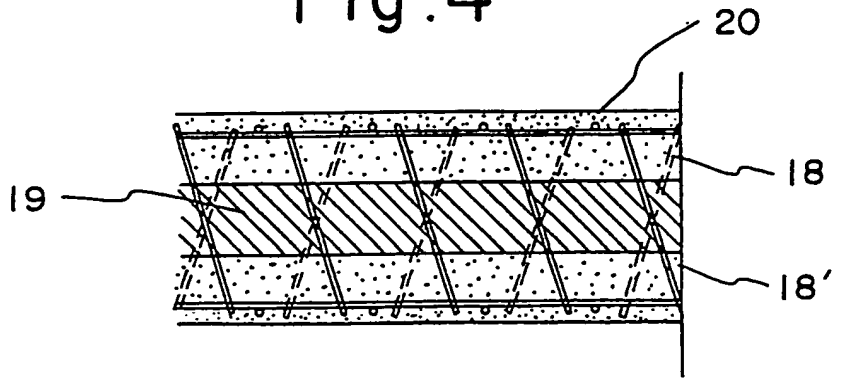


Fig. 5

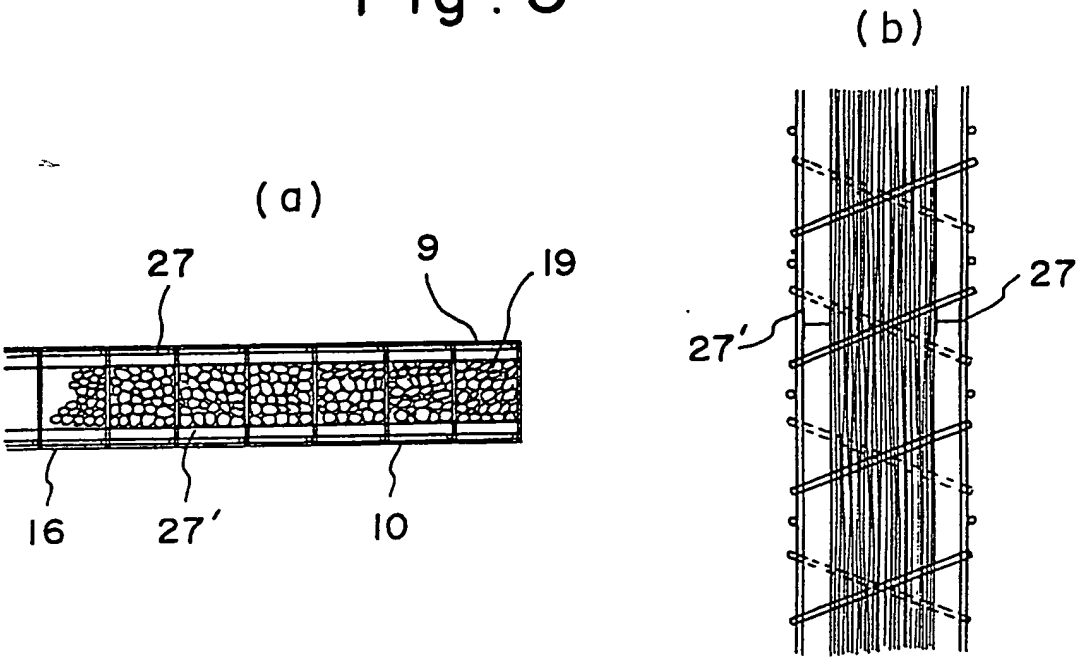


Fig. 6

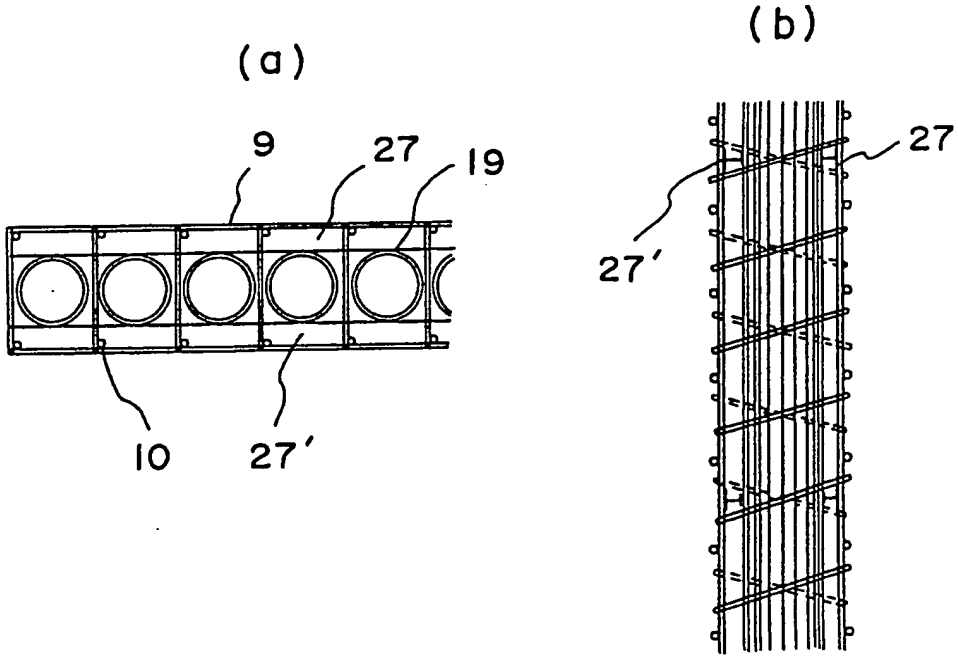


Fig. 7

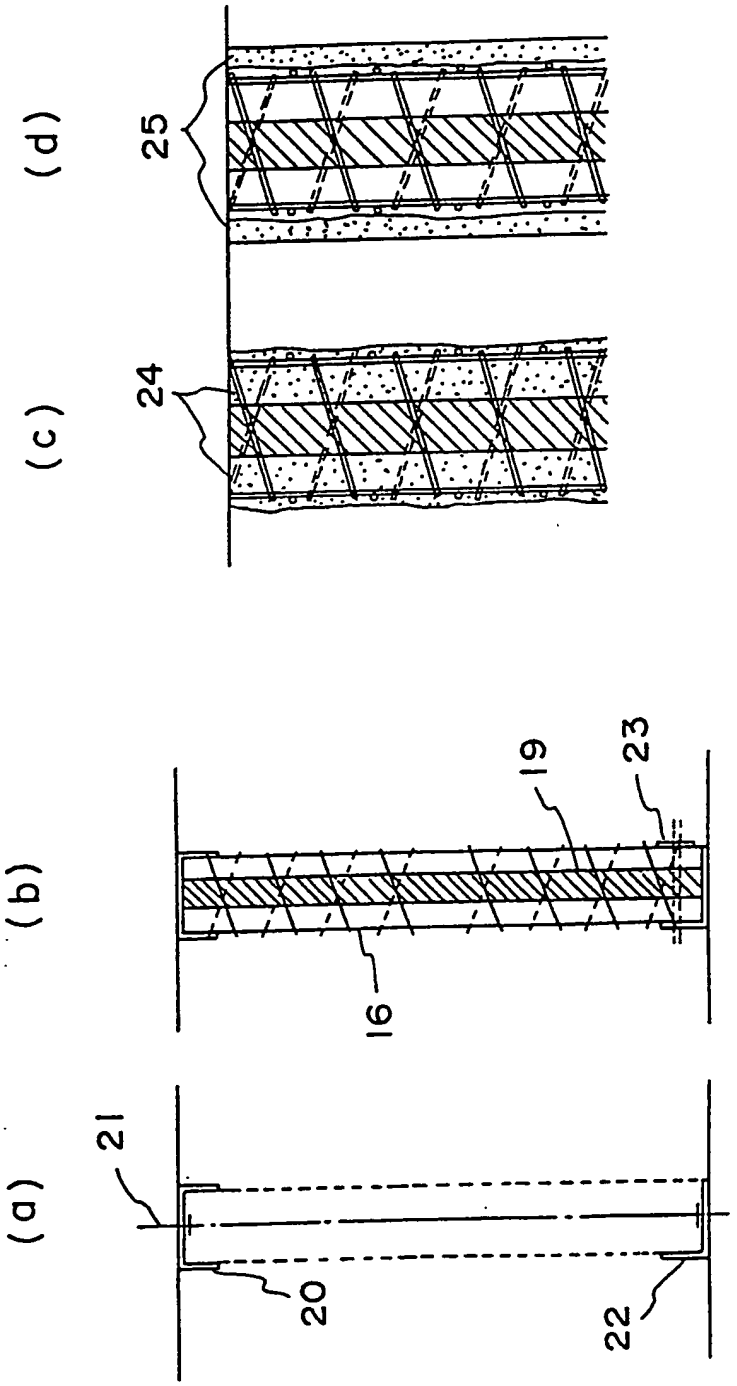


Fig. 8

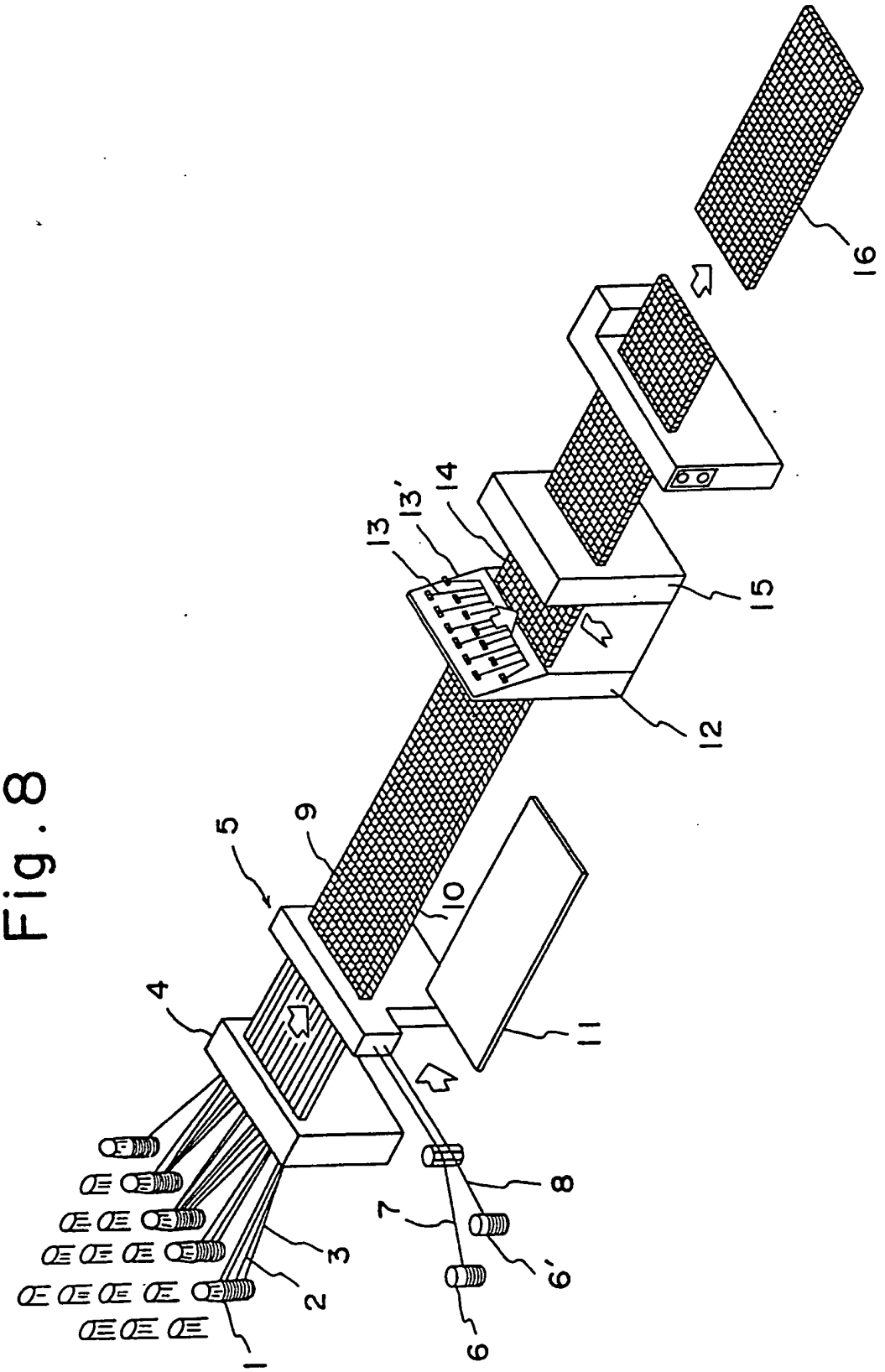


Fig. 9

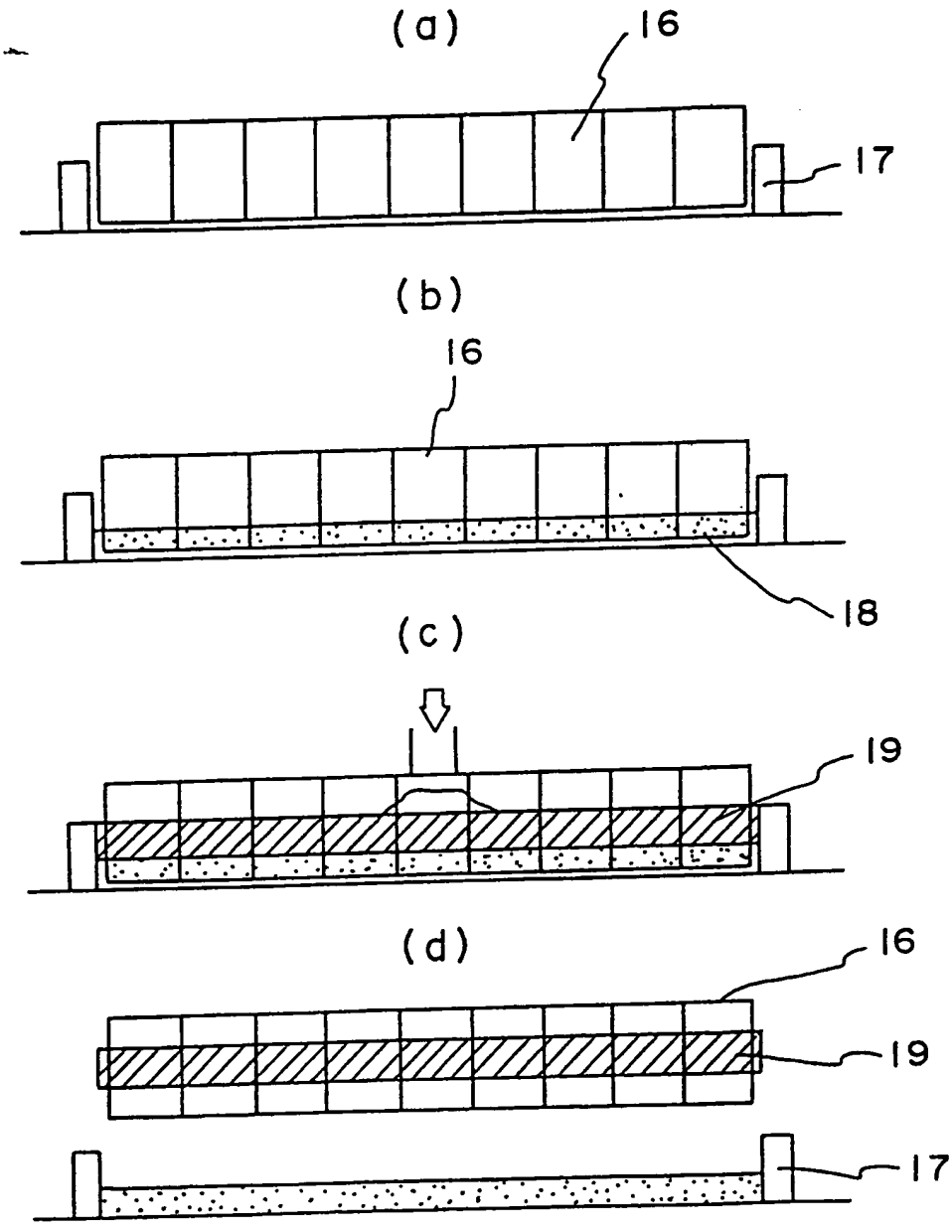


Fig. 10

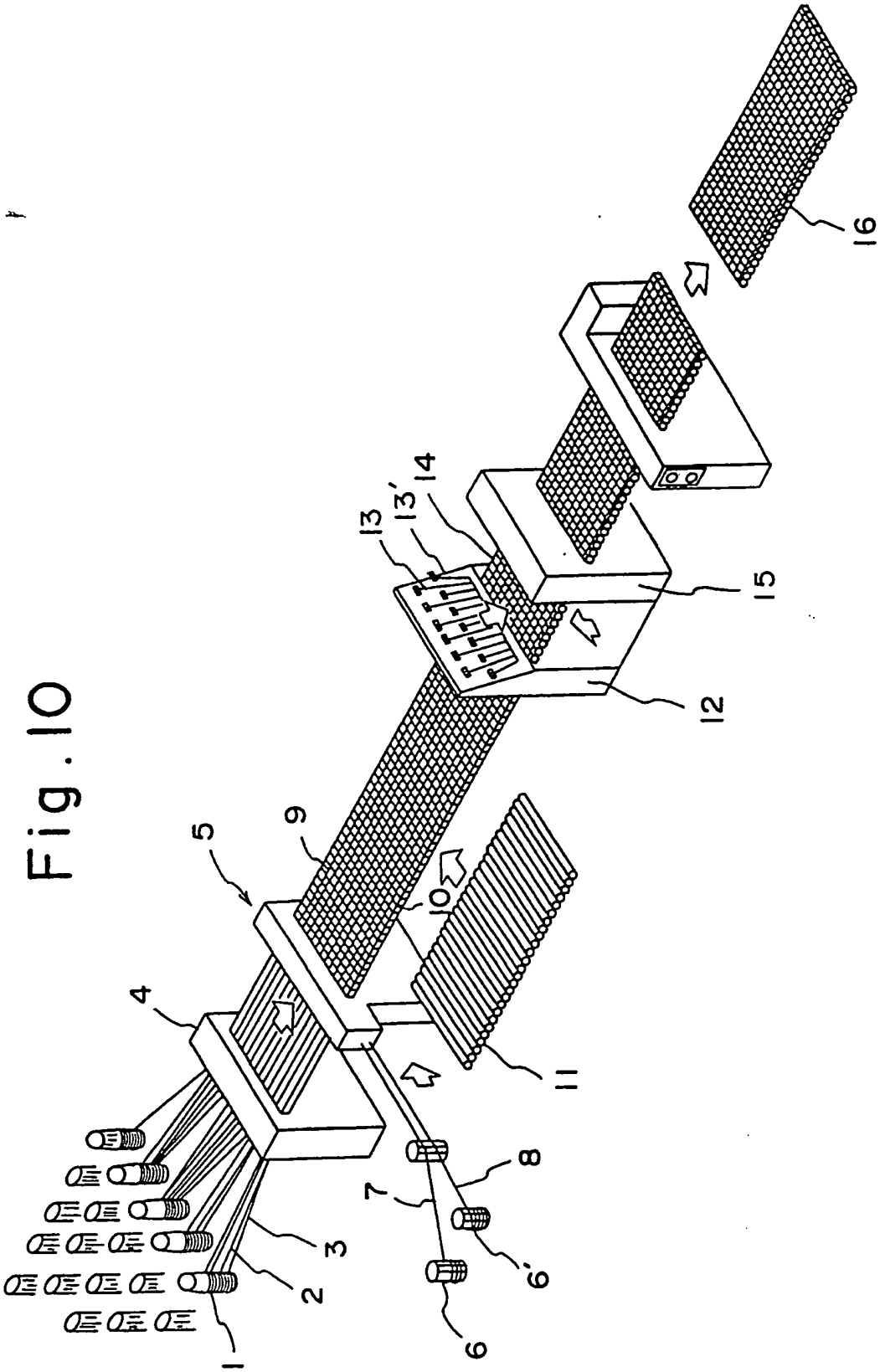


Fig. 11

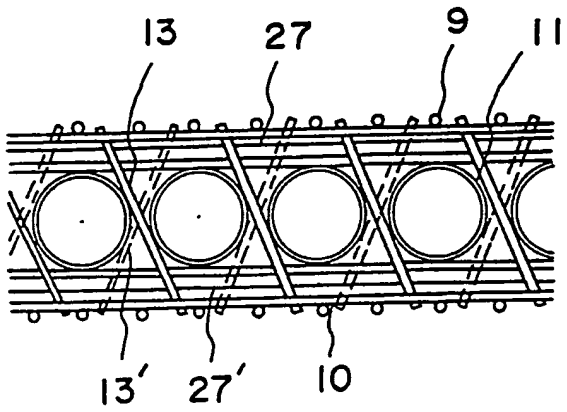


Fig. 12

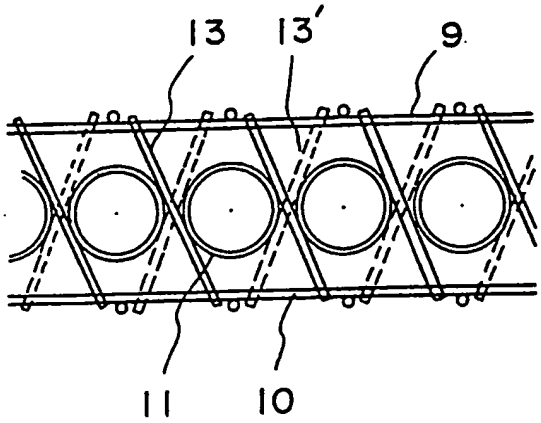


Fig.14

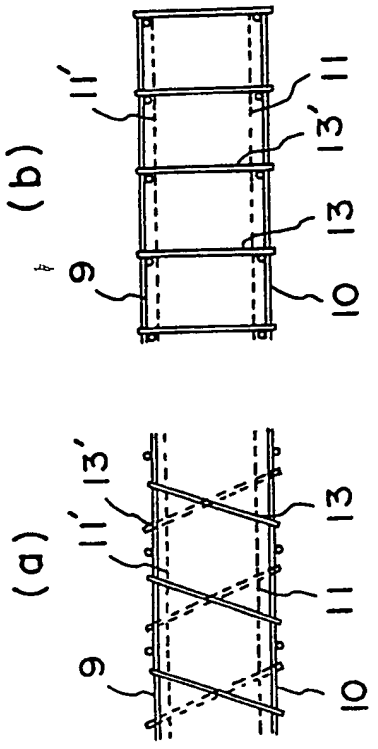


Fig.13

Fig.15

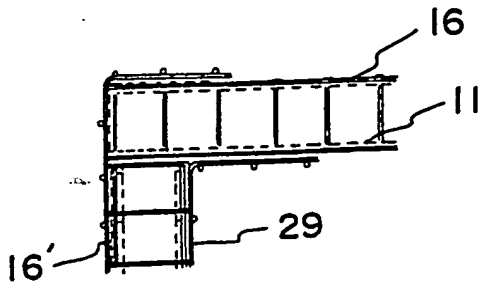


Fig.16

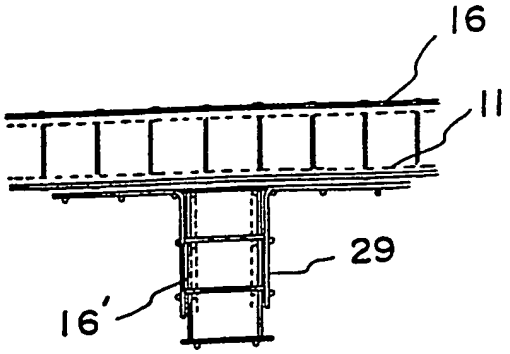


Fig.17

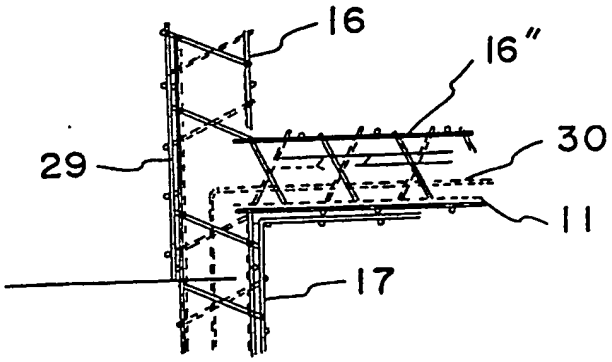


Fig.18

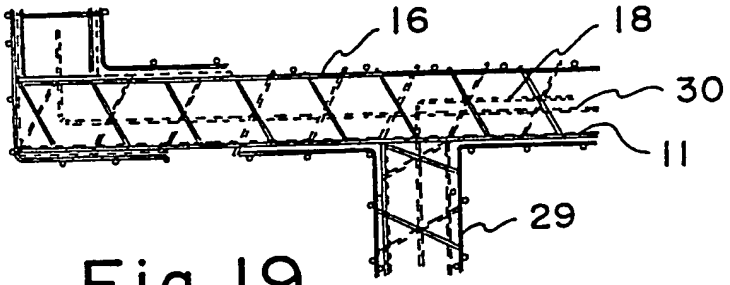


Fig.19

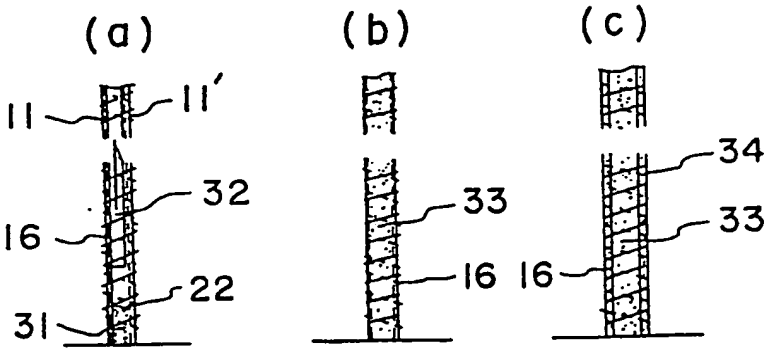


Fig. 20

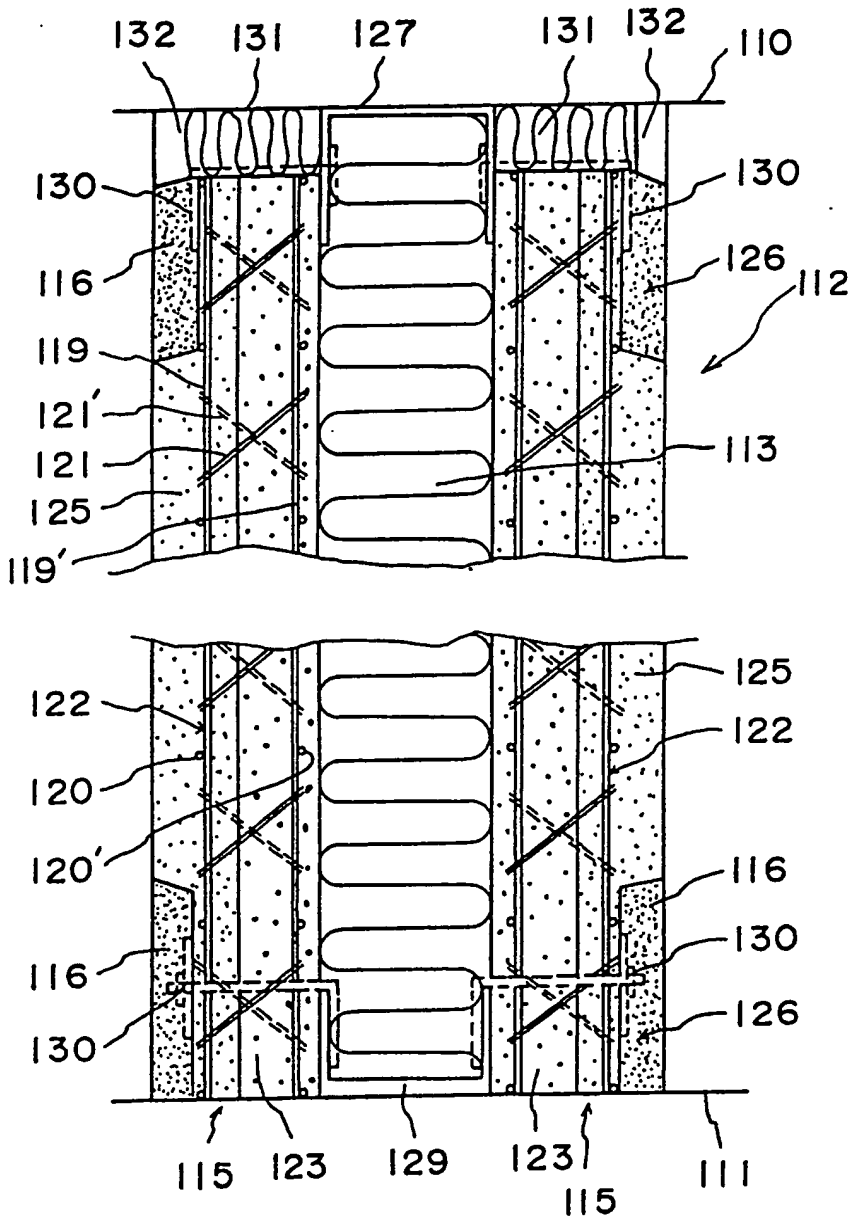

132
131
127
131
132
110
130
130
116
126
112
119
121'
121
113
125
119'
122
125
122
120
120'
116
116
130
130
126
115
123
129
123
115
111

Fig. 21

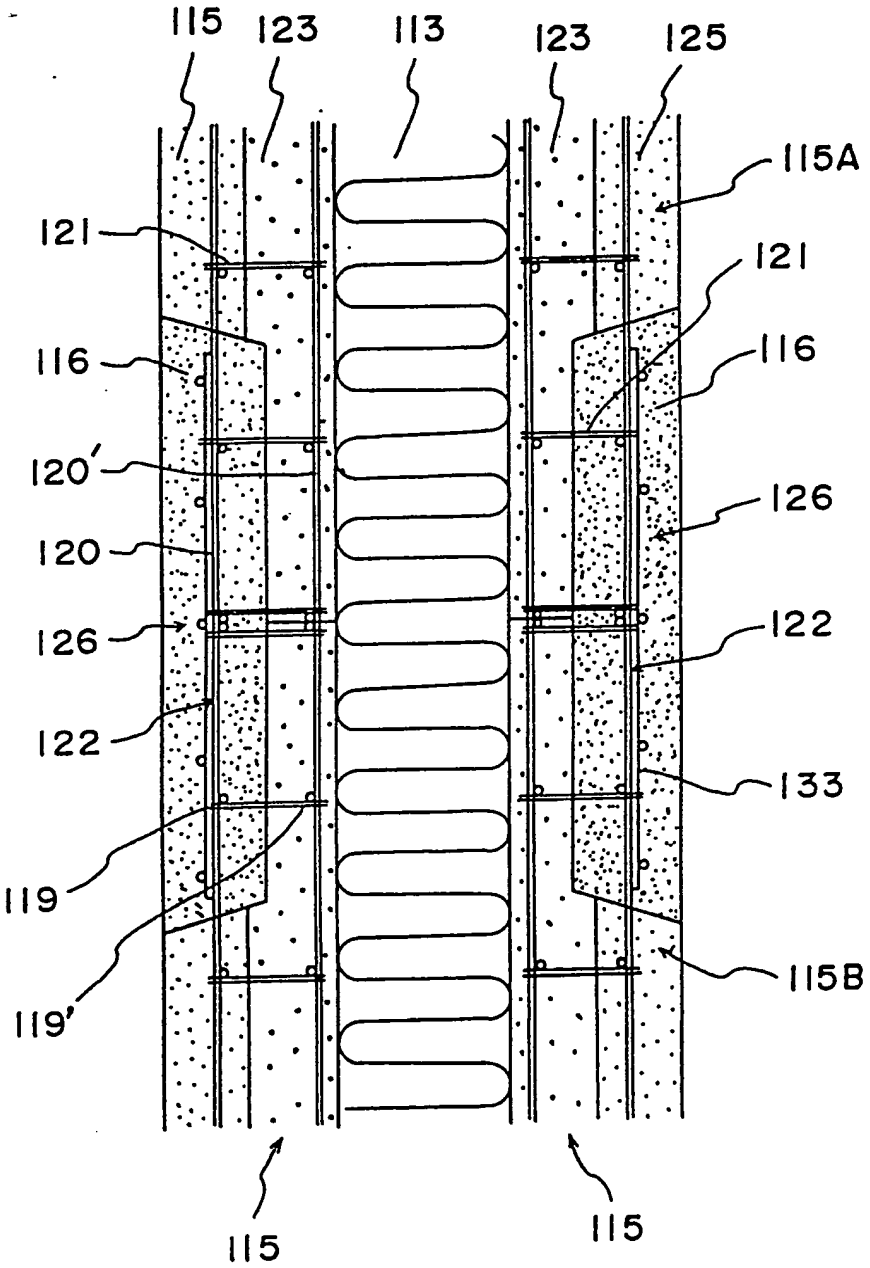

115
123
113
123
125
115A
121
121
116
116
120'
126
120
126
122
122
133
119
119'
115B
115
115

Fig. 22

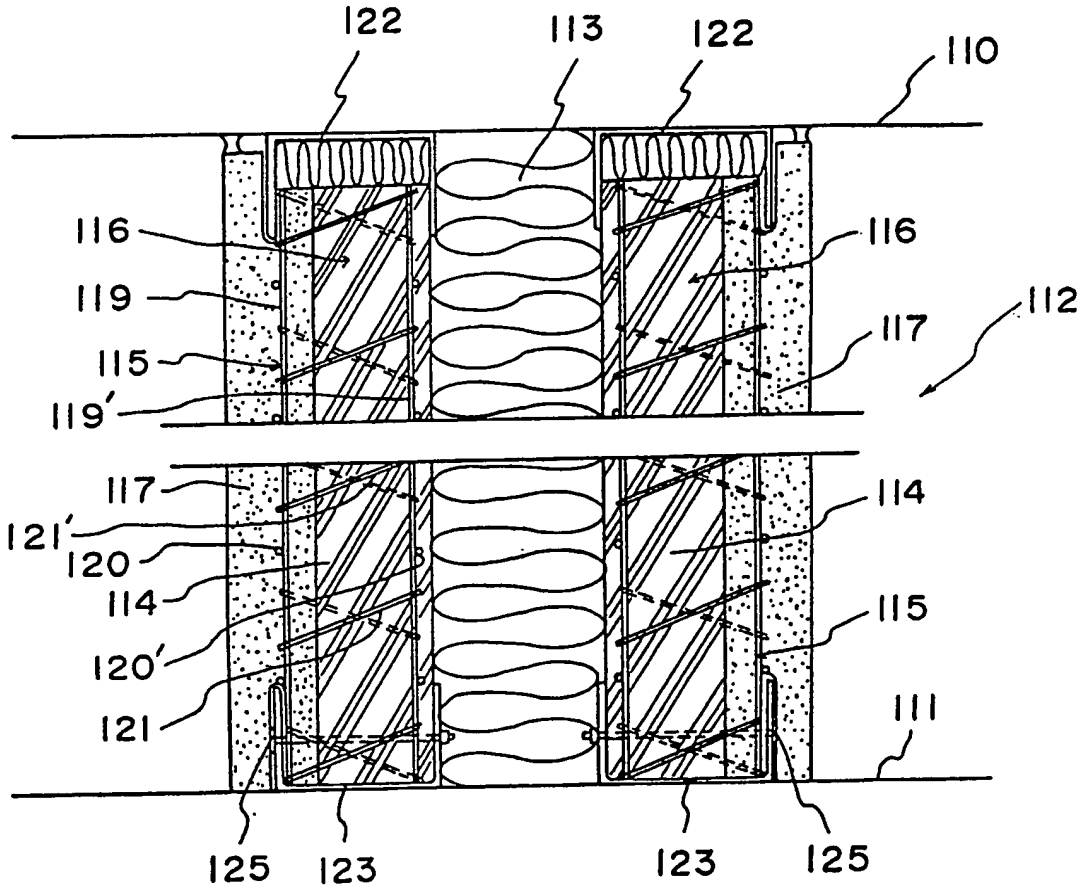

122
113
122
110
116
116
119
112
117
115
119'
117
114
121'
120
114
115
120'
121
111
125
123
123
125

Fig. 23

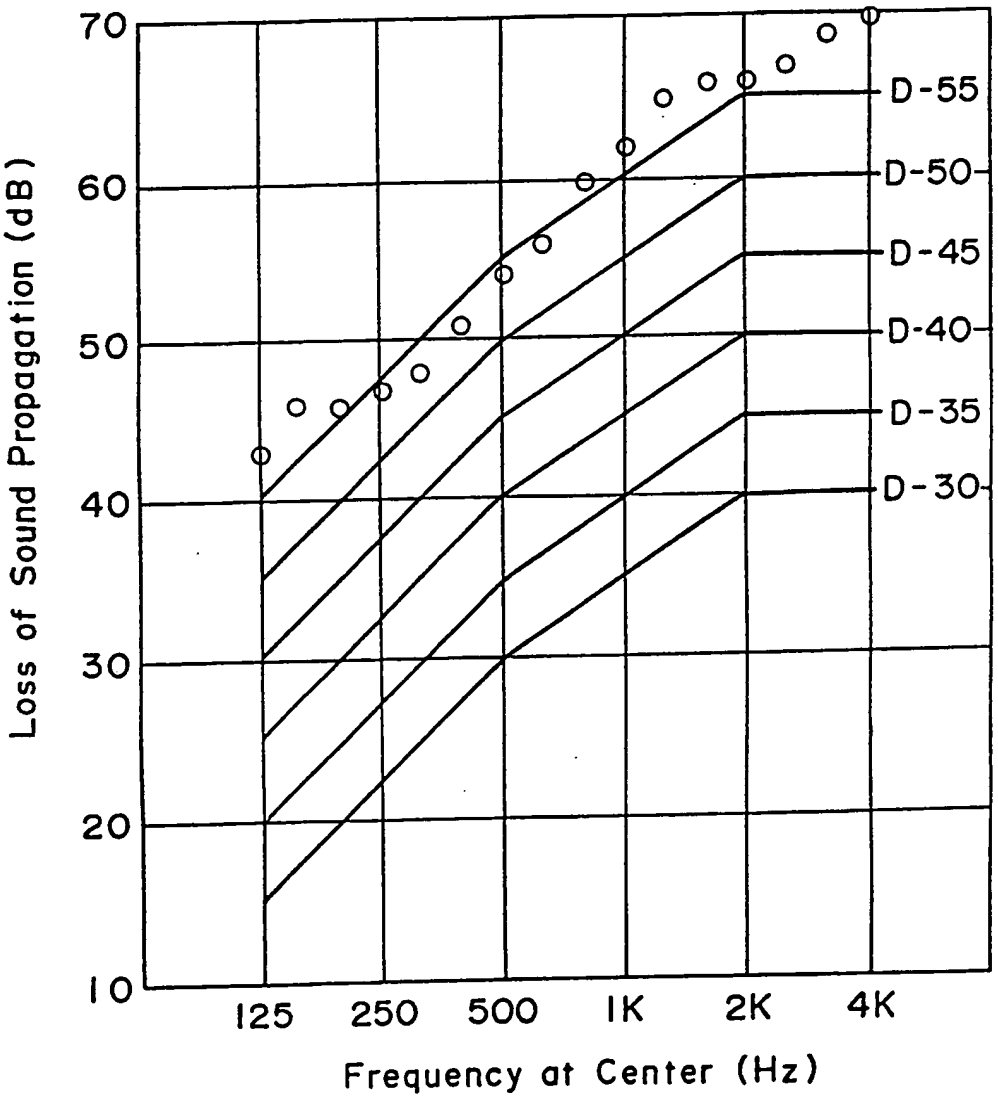

70
60
50
40
30
20
10
Loss of Sound Propagation (dB)
D-55
D-50
D-45
D-40
D-35
D-30
125
250
500
1K
2K
4K
Frequency at Center (Hz)

Fig. 24

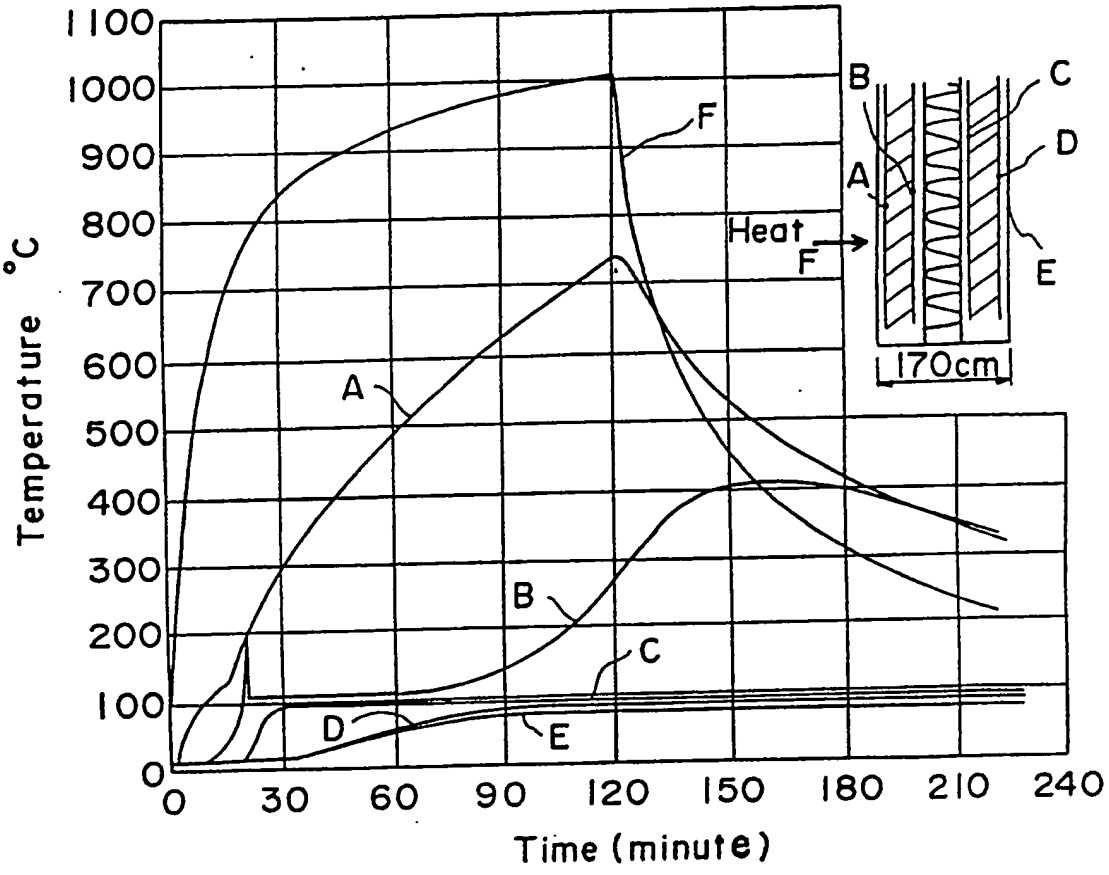
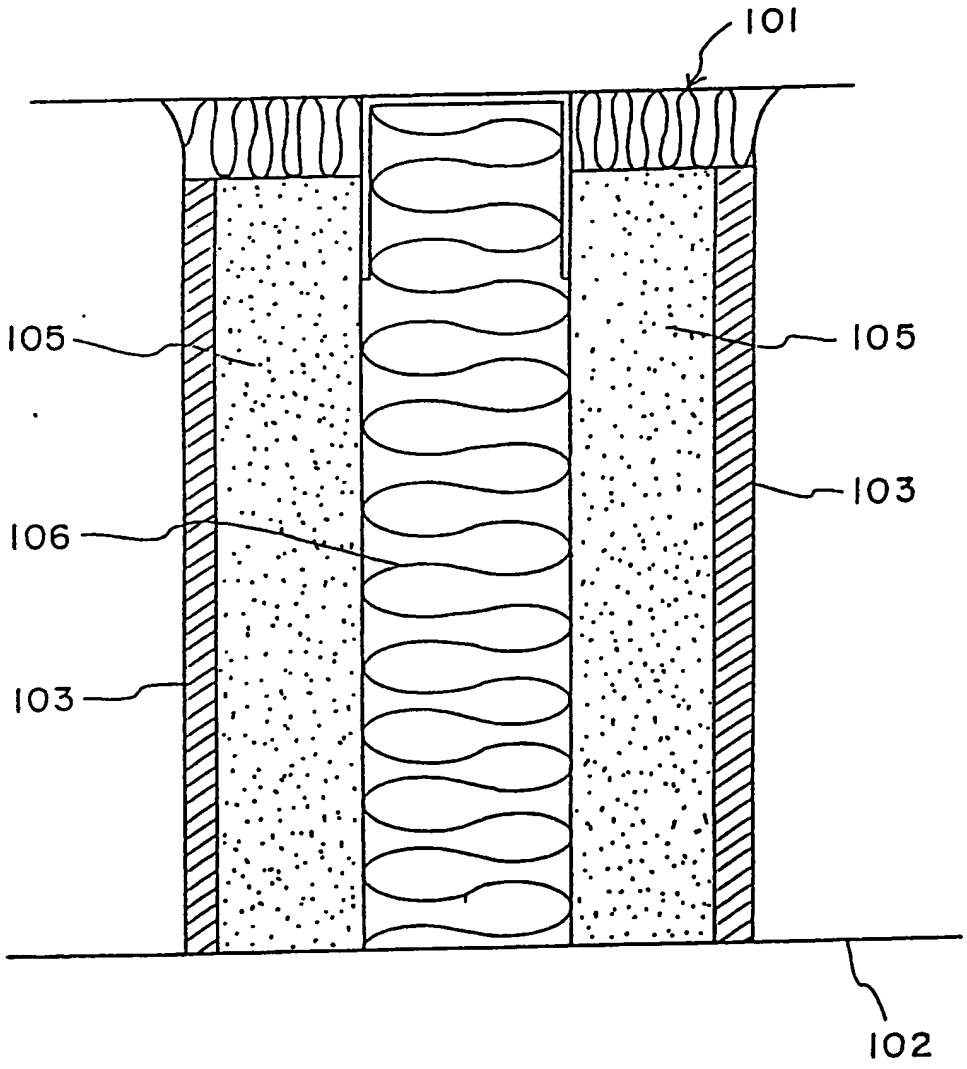

1100
1000
900
800
700
600
500
400
300
200
100
0
Temperature °C
0
30
60
90
120
150
180
210
240
Time (minute)
A
B
C
D
E
F
Heat
170cm

Fig. 25



WIRE MESH TRUSS COMPLEX WALLS FOR BUILDING WALL ELEMENTS

This invention relates to a method of building a wire mesh truss complex wall applicable in walls for dividing one apartment from another (hereinafter referred to as "dividing walls"), or in partition walls requiring a sound-insulating property, which are primarily employed in high-rise apartment complexes; and to these complex walls thus formed.

This application is divided from Application No. 8625873 (GB-A-2196660) which claims wire mesh trusses and panels and their manufacture.

Precast (PC) panels, ALC Panels and concrete blocks have long been used as materials for partition walls, buildings with few stories and walls. However, these materials generally are heavy and lacking in both sound-insulating and adiabatic properties. Hence there is need for better building materials.

To this end, light-weight and strong building materials have recently been developed by combining a number of different expandable synthetic resins, and methods of building structures using these materials have been proposed. Specifically, structural panels are made by sandwiching a rectangular block of expandable light-weight plastic between grid-shaped reinforcement trusses, strengthening the mutual joints by application of pressure, subsequently placing supporting reinforcing bars across the reinforcement grids and welding the reinforcing bars to the grids.

Alternatively, structural panels are made by arranging grid-shaped reinforcement trusses in parallel with a prescribed spacing therebetween, followed by placing supporting reinforcing bars across these trusses and welding the reinforcing bars to form a solid truss, and then forming a layer of expandable synthetic resin in the intermediate portion of the solid truss. In either case, the structural panels are carried to a construction site where they are erected into a structure at a predetermined location of a building. This is followed by the spraying of concrete at the site.

A "mesh molding frame" method of construction has also been proposed as an improvement on the conventional construction method based on pouring concrete in board-type molding flasks. Specifically, a metal underlay such as a wire net is affixed to both sides of a hollow net frame, concrete is poured in the interior and then a surfacing mortar is sprayed and set.

The conventional building materials such as the PC panels, ALC panels and concrete blocks have none of the prescribed properties mentioned above, namely the properties of light weight, sound insulation and thermal insulation. The structural panel obtained by combining the expandable synthetic resin and the

grid-shaped reinforcement trusses satisfies the requirement for light weight. However, since the method of fabricating the solid truss entails arranging a number of the grid-shaped reinforcement trusses in parallel side by side, laying columnar reinforcing bars across these trusses and then welding the same in order to obtain an integrated structure, manufacture requires both an extended period of time and machinery having a special mechanism and involving various process steps.

Specifically, to manufacture the solid truss, two parallel iron reinforcing bars are fitted into prescribed grooves in a die having grooves for receiving the positioned iron bars. Next, truss ribs of a prescribed length crossing the iron bars at a predetermined angle are dropped onto the iron bars and are precisely fitted into intersecting grooves on the die, after which welding is performed to form an integrated structure. Thus there is formed a single, continuous grid-shaped reinforcement truss composed of the two parallel iron bars and the truss ribs crossing these iron bars.

Next, the grid-shaped reinforcement truss is cut into predetermined lengths, a number of which are fed out in a state where they are juxtaposed in parallel. Supporting iron bars intersecting the whole of the two upper and lower parallel iron bars are laid across at right angles to the longitudinal direction and welding is performed from above and below to form an integrated

solid truss.

Thus, manufacturing the solid truss requires the use of a special die and employs means in which the manufacturing process is interrupted before the next process is begun. The result is poor manufacturing efficiency overall. Furthermore, with the "mesh-type molding" method of construction, the net frame of a support column generally is weak. Therefore, even if there are columns and beams, it is always required to build wall reinforcing bars into the net frame. High cost is the result.

Plans for high-rise apartment complexes generally call for construction of dividing walls and partition walls by a PC construction method using RC, which is poured on site, or PC panels, ALC panels or concrete blocks serving as earthquake-resistant elements. However, these materials generally are very heavy, difficult to work with and costly.

With the recent trend toward ever taller buildings, it has become necessary to increase the non-load bearing capacity of dividing walls and lighten the same by a pure rigid frame structure, and various methods of constructing these dividing walls have been developed. More specifically, because of a reduction in weight at the upper part of buildings, simplification of the construction work and the use of large molding frames in high-rise apartment complexes, there is a trend toward reducing the weight of dividing

walls by fabrication after the construction of the building proper.

One example of the prior art is a dividing wall illustrated in Fig. 25. Two steel fiber-reinforced concrete panels 105, 105 each having a plaster board (PB) 103 adhered to one side are arranged to face each other in parallel relation at a dividing area between an upper floor 101 and a lower floor 102. A material 106 exhibiting excellent sound absorption, fire resistance and an adiabatic property, such as glass wool, is packed into the space between the panels 105, 105, thus constructing the dividing wall.

The conventional dividing wall employing these concrete panels is very heavy and difficult to handle. It also does not lend itself to labor reduction methods using robotization and is comparatively expensive. Moreover, the fact that the PB is adhered detracts from the durability and reliability of the dividing wall.

An object of the invention is to provide a method of building a complex wall capable of being carried into a construction site in a simple and easy manner and assembled with ease, and which makes it possible to produce a dividing wall at low cost in a short period of time.

According to one aspect of the invention, we provide a mesh truss complex wall comprising:

light-weight panels, each comprising a wire mesh truss, arranged and secured so as to fixedly clamp a sound absorber arranged at a dividing wall portion;

light-weight mortar layers formed on the surface of each of said light-weight panels, and

a layer of ordinary mortar then formed on the light-weight mortar and cured.

A complex wall of a wire mesh truss thus comprises a sound absorber arranged at a dividing wall portion, and light-weight panels arranged and secured so as to fixedly clamp the sound absorber. A method of building the complex wall comprises the steps of constructing each of the light-weight panels from a solid wire mesh truss, a light-weight mortar layer or light-weight expandable mortar layer formed on one side of the solid wire mesh truss, and an ordinary mortar layer formed on the other side of the solid wire mesh truss, forming a joint portion having a cut-in portion on the light-weight panel, and applying mortar to the joint portion at a job site.

In the present invention, the panels used can be carried into a construction site in a simple manner and readily assembled by hand without using a heavy-duty crane. It is therefore possible to fabricate a wall or the like ina a short period of time and at low cost. Furthermore, since mortar is sprayed on following the assembly operation at the location of a wall, the wall can be manufactured simply, quickly and inexpensively.

In accordance with the method of building a solid wire mesh truss complex wall of the present invention, the light-weight panel comprises the light-weight mortar and ordinary mortar, which have different specific gravities. This enables the sound insulation property to be improved. In addition, the panels can be easily carried in to the construction site using a small lifting crane and then assembled by hand in a simple manner, and the light-weight panels can be joined by mortar sprayed on at the site. This makes it possible to improve operability and lower cost. The invention also lends itself well to robotization so that a further reduction in labor can be achieved.

Since the wire mesh truss extends up to the corners of the light-weight panel, the panels do not easily break, thus enabling assembly to be accomplished with ease even by inexperienced workers.

Since the mortar is sprayed on at the site, smooth, continuous surfaces can be obtained without seams at the joints. In addition, panels are not interconnected by iron reinforcing rods or an iron framework. As a result, sound does not propagate through the panels, thus providing an enhanced sound insulating property.

Another advantage of the invention is that durability and reliability are improved by virtue of the fact that the surface finish of the dividing wall is a cement-type finish.

The invention is illustrated by the following description taken in connection with the accompanying drawings, in which:

Figs. 1 to 19 relate to trusses and panels as described and claimed in the aforesaid parent application and a copending divisional application;

Figs. 20 and 21 are respectively longitudinal and horizontal sectional views of a complex wall made according to the present invention;

Fig. 22 is a longitudinal sectional view illustrating another embodiment of a complex wall made from a truss;

Figs. 23 and 24 show graphs describing the results of experiments concerning sound insulation, heat resistance and thermal insulation; and

Fig. 25 is a longitudinal sectional view of a conventional dividing wall.

Figs. 1 to 19 are described in the aforesaid application.

Figs. 20 and 21 illustrate an embodiment of a method of constructing a complex wall using light-weight panels according to the invention.

A dividing wall 112 comprises a material 113, such as glass wool, exhibiting excellent sound absorption, fire resistance and thermal insulating property, light-weight panels 115, 115 arranged to face each other from both sides of the glass wool 113, and joint portion mortar layers 116, 116 provided on the outer surfaces of the light-weight panels 115, 115 by application at the site.

The light-weight panel 115 is produced beforehand by precasting. A wire mesh truss 122 is constructed by welding truss ribs 121, 121' between two layers of wire mesh obtained by welding longitudinal wires 119,119' and transverse wires 120,120' into meshes, by any of the methods described in the aforesaid parent application. As shown in Figs. 20 and 21, the truss ribs 121,121', which are inclined in mutually opposing directions, are integrally welded to the longitudinal wires 119,119'. One side of the wire mesh truss 122 thus constructed is fitted into a mold (not shown, e.g. as in Fig 3) having a predetermined depth. A layer of light-weight mortar or light-weight expandable mortar 123 is formed in the mold and allowed to cure for a predetermined period of time. A layer of ordinary mortar 125 is then formed on the light-weight mortar or light-weight expandable mortar 123, followed

by the prescribed curing. The whole is then removed from the mold. In forming the layer of ordinary mortar 125, a mold is used to form a joint 126 which bites into the outer peripheral portion of the light-weight panel 115.

We now describe a method of building a wire mesh truss complex wall having the foregoing construction. A fixing channel 127 is secured to an upper floor 110, and a fixing channel 129 is secured to a lower floor 111. Thereafter, a material 113 such as glass wool exhibiting excellent sound absorption, fire resistance and thermal insulation is stacked between the channels 127, 129, the light-weight panels 115, 115 are arranged on both sides of the glass wool 113, and the light-weight panels 115, 115' are secured by a clamping member 130. This is followed by filling the space defined by the light-weight panels 115, 115' and the upper floor 110 with glass wool 131. Mortar 116 is then applied at the construction site to the joint portion 126 formed on the outer peripheral portion of the light-weight panels, whereby mutually adjacent light-weight panels are joined together. Finally, sealing is effected by a sealing member 131 to complete the dividing wall.

In joining the mutually adjacent light-weight panels together by the mortar 116 applied at the site, as shown in detail in Fig. 22, a wire mesh 133 is laid in the joint portion 126 formed by mutually adjacent light-weight panels 115A, 115B, after which the mortar 116 is applied at the site to join the panels 115A, 115B together with greater strength.

It should be noted that the material 113 exhibiting the excellent sound absorption, fire resistance and thermal insulation is not limited to glass wool, for it is also permissible to employ rock wool or the like.

Fig. 22 illustrates another embodiment of a method of constructing a complex wall using light-weight panels. A dividing wall 112 formed at a dividing section between the upper floor 110 and lower floor 111 comprises the material 113 such as glass wool exhibiting excellent sound absorption, fire resistance and thermal insulating property, light-weight panels 116, 116 arranged to face each other from both sides of the glass wool 113 and formed from light-weight expandable mortar 114 and a wire mesh truss 115, and light-weight mortar layers 117, 117 sprayed onto the outer surfaces of the light-weight panels 116, 116 at the site.

The light-weight panel 116 is produced by precasting. The wire mesh truss 122 is constructed by welding truss ribs 121, 121' between two layers of wire mesh obtained by welding longitudinal wires 119,119' and transverse wires 120, 120' into meshes. As shown in Fig. 22, the truss ribs 121, 121', which are inclined in mutually opposing directions, are alternately inserted in a direction orthogonal to the longitudinal direction of the wire mesh truss 115 and are integrally welded to the longitudinal wires 119, 119'. One side of the wire mesh truss 115 thus constructed is fitted into a molding trough (not shown) having a predetermined depth. A layer of light-weight mortar

or light-weight expandable mortar 114 is formed in the mold and allowed to cure for a predetermined period of time. The whole is then removed from the mold.

One of the light-weight panels 116 is inserted into a fixing channel 122 arranged on an upper floor 110, and the panel is set in a fixing angle iron 123 arranged on the lower floor 111. After the panel is fixed by a locking bolt 125, the material 113 such as glass wool exhibiting excellent sound absorption, fire resistance and thermal insulation is stacked on the inner side of the panel. Next, the other light-weight panel 116 is secured to the corresponding channel 122 and angle iron 123 in the same manner as the other panel. A layer of light-weight mortar 117 is then formed at the site by spraying to complete the dividing wall.

Figs. 23 and 24 show the results of experiments performed to determine the sound insulating characteristic as well as the fire resistance and adiabatic characteristics of the dividing wall constructed as set forth above. The sound insulation experiment was performed twice. In both cases, D-50 (first class according to the sound insulation perfomance standards of the "Japan Architectural Society") was surpassed, as shown by the experimental results of Fig. 23.

The results of the fire resistance experiment are shown in Fig. 24. As indicated by curve F, one surface of the panel was heated for two hours at a temperature fo 2000°F along a fire resistance test heating temperature

curve, as stipulated by the Japanese Industrial Standards (JIS). Even after two more hours the temperature on the opposite side of the panel did not rise above 80°C, as shown by curve E. Thus the dividing wall of the present invention satisfies the requirements demanded by high-rise apartment complexes.

CLAIMS

1. A mesh truss complex wall comprising:

light-weight panels, each comprising a wire mesh truss, arranged and secured so as to fixedly clamp a sound absorber arranged at a dividing wall portion;

light-weight mortar layers formed on the surface of each of said light-weight panels, and

a layer of ordinary mortar then formed on the light-weight mortar and cured.

2. A complex wall as claimed in Claim 1, wherein the layer of ordinary mortar is formed at the job site.

3. A complex wall as claimed in Claim 1 or 2, wherein the light-weight mortar and ordinary mortar have different hardnesses or specific gravities.

4. A complex wall according to any preceding claim, wherein said light-weight mortar layer is made of one or more of rock wool, light-weight expandable mortar and rice hull-filled cement.

5. A complex wall as claimed in any preceding claim, wherein the light-weight mortar layer is formed on one side of each of said wire mess truss.

6. A mesh truss complex wall, substantially as herein-before described with reference to any of Figs. 20 to 22 of the accompanying drawings.

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